California High-Speed Rail Authority

RFP No.: HSR 13-57

Request for Proposals for Design-Build Services for Construction Package 2-3

Reference Material, Part A.1
Standard Specifications Changes

SECTION 31 62 00

DRIVEN PILES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials, equipment, and procedures for driving piles.

B. Pile Types.

C. Determination of Length.

D. Indicator Piles and Test Piles.

E. Axial Compression and Tension Load Tests.

F. Lateral Load Tests.

G. Dynamic Pile Testing.

H. Installation of Piles.

1.2 DEFINITIONS

A. Indicator Pile: An individual pile that is tested and observed to determine its behavior during driving.

B. Test Pile: An individual pile which is tested and observed under static axial compression or tension load, under lateral load, and under dynamic load tests.

C. Reaction Pile: An individual pile that provides the reaction load required to perform the load test on a test pile. During this process the reaction pile can be subjected to either an axial compression load or an axial tension load, or lateral load.

D. Production Piles: Piles that are purchased and delivered for incorporation in the permanent structure.

E. Contractor's Geotechnical Engineer: Geotechnical engineer who is part of the Contractor's organization and licensed in the State of California to practice geotechnical engineering.

F. Contractor's Structural Engineer: Structural engineer who is part of the Contractor's organization and licensed in the State of California to practice structural engineering.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO LRFD Bridge Design Specifications

B. ASTM International (ASTM):

1.	ASTM A36	Standard Specification for Carbon Structural Steel
2.	ASTM A252	Standard Specification for Welded and Seamless Steel Pipe Piles
3.	ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
4.	ASTM A690	Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
5.	ASTM D1143	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load
6.	ASTM D3689	Standard Test Methods for Deep Foundations Under Static Axial Tensile Load
7.	ASTM D3966	Standard Test Methods for Deep Foundations Under Lateral Loads
8.	ASTM D4945	Standard Test Method for High-Strain Dynamic Testing of Deep Foundation Piles

C. American Welding Society (AWS):

1. ANSI/AWS D1.1 Structural Welding Code - Steel

1.4 REGULATORY REQUIREMENTS

A. Comply with applicable requirements of the California Code of Regulations, Title 24, Part 2, California Building Code, Chapters 18 and 18A, "Foundations and Retaining Walls."

1.5 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings of pile types as follows:

1. Type A, Steel H-piles: Show typical details of size, weight, splices, tip construction, connection to pile cap, and welding of splice connection. Location and design of splices subject to Contractor's structural engineer's approval.
2. Type B, Concrete filled steel pipe piles: Show typical details of sizes, configuration, tip construction, connection to pile cap, and welding of section connection, details for developing composite behavior between the concrete and steel pipe, and class of concrete fill. Location of section connections subject to Contractor's structural engineer's approval.
3. Type C, Pre-cast, pre-stressed concrete piles: Show typical details of sizes, configuration, pre-stressing steel, tendon arrangement, class of concrete, lifting devices, curing methods, and pre-stressing methods. Include engineering calculations of working stresses. If splicing is required, submit details. Splicing, design, and location of splices subject to Contractor's structural engineer's approval.
4. Test Piles: Show tension steel reinforcement and connections for uplift loads. Include engineering calculations of working stresses.

B. Concrete Reinforcement: Refer to 03 20 00, Concrete Reinforcing, for submittals regarding reinforcement.

C. Portland Cement Concrete: Refer to Section 03 05 15, Portland Cement Concrete, and Section 03 30 00, Cast-in-Place Concrete, for submittals regarding concrete.

1. Include submittal for tremie concrete equipment and placement method.

D. Pile Driving Sequential Layout:

1. Submit layout drawings showing the proposed sequence of driving the piles.
2. On the sequential layout, show each pile by identification, its driving sequence number, type, size, axial service and ultimate load bearing capacities, lateral service and ultimate load capacities, and pile tip elevation as planned.
3. Submit a pile numbering plan that clearly identifies and numbers each pile for reference.

E. Pile Tip Elevations: Submit a list and plan prepared by the Contractor's geotechnical engineer showing recommended pile tip elevations and planned blow count after completion of driving of indicator piles and load-testing of test piles for the Contracting Officer's acceptance. After receipt of Contracting Officer's acceptance, Contractor shall order piles to correct length to meet recommended pile tip elevation and cutoff elevation.

F. Pile Driving Record. Maintain a pile driving record during pile driving and submit it upon completion of each day's pile driving. On the record indicate, for each pile driven, the information specified in Paragraph entitled "Pile Driving Sequential Layout" in this Article, and the following: type and rating of driving equipment, overall blow count per foot and number of blows per inch penetration for the last 12 inches, and any unusual conditions encountered during driving. Also record start and end time of pile installation.

1. The Contractor shall submit a certified copy of the pile driving record to the Contracting Officer for record purposes within 7 days following completion of the pile driving.

G. Pile Driving Analyzer (PDA) and Case Pile Wave Analysis Program (CAPWAP) Records: Submit the PDA and CAPWAP results to the Contracting Officer within five days following completion of the PDA testing.

H. Immediately following completion of load testing, submit two copies of the test report for each test pile to the Contractor's geotechnical engineer for review and approval. Submit copy to the Contracting Officer. Include in the test report the data required by ASTM D1143, ASTM D3689, and ASTM D3966, as applicable.

I. Equipment Review and Drawings:

1. Submit the completed "Pile and Driving Equipment Data" form located at the end of this Section to the Contracting Officer a minimum of 14 days before driving of piles, including indicator, test, and production piles.
2. Submit complete list of the equipment proposed for use, including a description of the characteristics of each piece of driving equipment.
    a. Indicate on the submittals that the Contractor's geotechnical engineer has reviewed the proposed driving equipment, accessories, and methods and checked the adequacy of the equipment and methods for the conditions expected to be encountered.
    b. Should the equipment used by the Contractor prove to be inadequate to drive the scheduled types of piles at the locations indicated or should the use of accessories show damage to the piles because of inadequate or inappropriate equipment or methods, replace or use different types of equipment and accessories, or both, as

appropriate for the conditions encountered. Submit the new equipment for approval prior to use.

3. Submit Shop Drawings of driving accessories showing compatibility with the size, configuration, handling, and driving requirements of each type of pile indicated.
4. Submit Shop Drawings showing the methods and equipment proposed for loading test piles. The load test reaction frame submittal shall be prepared and stamped by a Registered Civil Engineer registered in the State of California.
5. Submit blow count for indicator and test piles as established by the Contractor's geotechnical engineer.

J. Specialty Consultant Qualifications: Submit qualifications of proposed specialty consultant for Contracting Officer's acceptance. Specialty consultant shall have a minimum of five years documented experience in conducting dynamic pile testing.

1.6 QUALITY ASSURANCE

A. Pile Requirements: General and specific pile requirements shall comply, at minimum, with the California Building Code, Sections 1807, 1808, 1810, 1807A, 1808A, and 1810A, as applicable, and AASHTO LRFD Bridge Design Specifications with Caltrans amendments, as applicable.

B. When special inspections are required under the California Building Code, Chapters 17 and 17A, as applicable, and AASHTO LRFD Bridge Design Specifications with Caltrans amendments, as applicable, make arrangements through the Contracting Officer with Authority-hired inspection agency and ensure that inspections are performed.

C. Piles delivered to the site that are cracked, bowed, chipped, under size, or that break under driving stresses shall be rejected. Remove such piles from the site and replace with sound piles. Piles broken under driving stresses may be cut off and left in place if approved by the Contractor's geotechnical engineer for the location.

D. Drive additional piles at locations designated by the Contractor's geotechnical engineer with written acceptance of the Contracting Officer when replacing damaged piles or piles driven out of position or alignment as specified under Article entitled "Installation Tolerances" herein.

E. Welding and welders' qualifications shall conform to the applicable requirements of Section 05 05 22, Metal Welding.

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PART 2 - PRODUCTS

2.1 PILES

A. Type A Piles: Steel H-piles conforming to ASTM A36 or ASTM A572, of size and type indicated. Steel H-piles conforming to ASTM A690 shall be utilized in corrosive environments such as marine environments and near direct current power transit systems, of size and type indicated. Steel plates and welding shall conform to applicable requirements of Section 05 12 00, Structural Steel Framing, and Section 05 05 22, Metal Welding.

B. Type B Piles:

1. Shell: Steel pipe conforming to ASTM A252, Grade 2, welded or seamless, of diameter and shell thickness indicated. Steel plates and welding shall conform to applicable requirements of Section 05 12 00, Structural Steel Framing, and Section 05 05 22, Metal Welding. For closed end pipe piles, end plates shall be structurally designed and adequately connected to the steel pipe to resist predicted driving stresses at the pile tip during installation.
2. Concrete Reinforcement: Conform to applicable requirements of Section 03 20 00, Concrete Reinforcing, of grades and sizes indicated.
3. Concrete: Conform to applicable requirements of Section 03 30 00, Cast-in-Place Concrete, and Section 03 05 15, Portland Cement Concrete. Provide minimum Class 4000-1-inch concrete unless otherwise indicated.

C. Type C Piles: Pre-cast, pre-stressed concrete piles, of sizes and requirements indicated, conforming to applicable requirements of Section 03 05 18, Pre-stressed Concrete. Provide minimum Class 6000-1-inch concrete unless otherwise indicated.

D. Other pile types not indicated above may be proposed subject to the acceptance of the Contracting Officer.

E. Provide cathodic protection as necessary.

2.2 PILE DRIVER

A. Equip pile driver in accordance with manufacturer's recommendations.

B. Leads:

1. Use with all types of hammers.
2. Free moving.
3. Hold in the required position with guys, stiff braces, or both. Hold the pile parallel to the leads.
4. Accommodate the maximum length of the pile segment, and extend to the lowest point that the hammer must reach. Obtain approval from the Contractor's geotechnical engineer before using the followers.

C. Driving Head: Fit the top of pile and provides full bearing.

D. Hammer:

1. With fully-operable adjustable settings.
2. Rated energy as much or greater than the value indicated on the foundation plans.
3. Install a new hammer cushion before beginning pile driving.
    a. Inspect the hammer cushion with the Contractor's geotechnical engineer present after completing 100 hours of pile driving.
    b. Replace the cushion when it loses 25 percent or more of its original thickness.

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PART 3 - EXECUTION

3.1 PILE TYPES

A. Piles shall be friction piles or combined friction and end-bearing piles as indicated. Piles shall be driven to the required penetration, as indicated.

3.2 DETERMINATION OF LENGTH

A. Piles shall be of such lengths as required to develop the specified capacity, to obtain the specified penetration, and to extend into the pile cap or footing block as indicated.

B. The Construction Drawings shall indicate the required type of piling, the required lateral, compression and tension capacity; the minimum penetration; location of indicator, test, and reaction piles; and the estimated pile tip elevation. Estimated tip elevations will be approximate, based upon subsurface explorations, and shall indicate the required lengths of indicator piles and test piles.

C. Lengths of production piles shall be determined by the Contractor from the data obtained from the driving of indicator piles and the load-testing of test piles. Refer to Article entitled "Submittals" herein for submittal of recommended pile tip elevations.

3.3 INDICATOR PILES AND TEST PILES

A. From the driving behavior and test pile data and the subsurface exploration data, the Contractor's geotechnical engineer shall determine the tip elevations of production piles. The Contractor's geotechnical engineer shall also determine the required penetration based upon settlement criteria, liquefaction criteria, or any other factors that in the opinion of this engineer are applicable to the work.

B. Based upon the information indicated on the Construction Drawings, order and drive the indicator piles and test piles. Determine compression, tension, and lateral capacities of the test piles in accordance with ASTM D1143, ASTM D4945, ASTM D3689, and ASTM D3966.

C. Drive indicator piles and test piles at the locations indicated and to the lengths specified by the Contractor's geotechnical engineer. Drive piles with impact hammers unless otherwise indicated. In general, the specified length of indicator piles and test piles shall be greater than the estimated length of production piles in order to provide for variation in soil conditions.

D. Driving equipment used for driving indicator and test piles shall be identical to that what the Contractor proposes to use for the driving of production piles.

E. The Contractor shall excavate the ground at each indicator and test pile to the elevation of the bottom of the pile-cap footing before the pile is driven, or the Contractor may employ "followers" to compensate for the extra depth. If "followers" are used, the same "followers" shall also be used for driving production piles.

F. Drive indicator piles and test piles to a hammer blow count established by the Contractor's geotechnical engineer at the estimated tip elevation. Mark the piles in one-foot intervals for the full length of test and indicator piles such that the marks are clearly visible during driving. Test piles that do not attain the hammer blow count established by the Contractor's geotechnical

engineer at a depth of 1 foot above the estimated tip elevation indicated shall be allowed to "set up" for 12 to 24 hours before being re-driven. A cold hammer shall not be used for re-drive. The hammer shall be warmed up before driving begins by applying at least 20 blows to another pile. For re-driven piles, the Contractor shall mark the piles in one inch intervals for the full length of re-drive such that the marks are clearly visible during driving.

G. If the specified hammer blow count is not attained on re-driving, the Contractor's geotechnical engineer, with the Contracting Officer's agreement, may direct the Contractor to drive a portion or all of the remaining pile length and repeat the "set up" – re-drive procedure. The Contractor's geotechnical engineer, with the Contracting Officer's agreement, may specify a longer "set-up" time before the pile is re-driven. Drive piles to the planned grade and, when not having the hammer blow count required, splice and drive piles until the required bearing is obtained.

H. Contractor's geotechnical engineer shall prepare a record of driving of indicator and test piles that shall include the number of hammer blows per foot for the entire driven length, the as-driven length of the test pile, cutoff elevation, penetration in ground, and any other pertinent information. If re-drive is necessary, the Contractor's geotechnical engineer shall record the number of hammer blows per inch of pile movement for the first foot of re-drive.

I. Remove indicator piles at completion of testing.

3.4 AXIAL COMPRESSION AND TENSION LOAD TESTS

A. Install test piles and reaction piles, of the same type and kind as permanent piles, in the locations indicated or at other locations as required by the Contractor's geotechnical engineer.

1. Reinforce test and reaction piles for the full length to resist uplift loads.
2. Install test piles vertically.

B. Test piles that pass the load test in an undamaged condition and were designed to meet project design requirements may be utilized as permanent piles in the work with the approval of both the Contractor's geotechnical and structural engineer. Reaction piles that were used to perform the pile load test and were designed to meet project design requirements may be utilized as permanent piles in the work, provided they are not damaged and that they have not moved upward more than 1/8 inch with the approval of both the Contractor's geotechnical and structural engineer. If upward movement has occurred, piles shall be re-driven to the previous elevation.

C. Either extract damaged test piles and reaction piles and remove from the site, or, with acceptance of the Contracting Officer, cut them off 3 feet below any structure to be installed above. Holes shall be backfilled with Class 3000 concrete.

D. Compression Load Tests: Tests shall be performed in accordance with ASTM D1143. Method of load test shall follow "Quick Load Test Method for Individual Piles" as specified in ASTM D1143, Section 5.6.

1. Commence loading of test piles not sooner than 72 hours after placement of concrete or 72 hours after installation of Type C piles. Type III cement may be used in test piles to accelerate achieving necessary minimum strengths.

2. The maximum test load shall be the ultimate load or twice the service design load whichever is greater as prescribed by the Contractor's geotechnical engineer. Apply the load in increments equal to 10 percent of the maximum test load, with a constant time interval between increments of 5 minutes. Maintain the maximum test load for not less than 15 minutes, unless the shaft has failed as determined by that engineer.
3. Remove the test load in increments equal to 25 percent of the maximum test load, with a constant time interval between increments of 5 minutes.
4. Measure the settlement and rebound of the test pile to the nearest 0.01 inch.

E. Tension Load Tests: Tests shall be performed in accordance with ASTM D3689. Method of load test shall follow "Quick Load Test Method for Individual Piles" as specified in ASTM D3689, Section 7.7. The maximum test load shall be the ultimate load or twice the service design load whichever is greater as prescribed by the Contractor's geotechnical engineer. Apply the load in increments equal to 10 percent of the maximum test load, with a constant time interval between increments of 5 minutes. Maintain the maximum test load for not less than 15 minutes, unless the pile has failed as determined by the Contractor's geotechnical engineer. Remove the test load in increments equal to 25 percent of the maximum test load, with a constant time interval between increments of 5 minutes.

F. The Contractor's geotechnical engineer shall require the Contractor to make additional load tests that are not indicated, in the event that the behavior of the test pile or any other pile shows any peculiarity, erratic action, or otherwise causes suspicion as to the reliability of the pile capacity.

G. Refer to the Article entitled "Submittals" herein for requirement for submitting test reports of load testing. Include in the test report the data required by ASTM D1143, ASTM D3689, and ASTM D3699, as applicable.

H. Following the completion of load tests, the Contractor's geotechnical engineer shall make a determination of the required penetration.

3.5 LATERAL LOAD TESTS

A. Tests shall be performed in accordance with ASTM D3966. Method of load test shall follow "Standard Loading Procedures" as specified in ASTM D3966, Section 6.1.

3.6 DYNAMIC PILE TESTING

A. Contractor shall hire a specialty consultant who specializes in dynamic pile testing. Dynamic measurements shall be taken by the specialty consultant during the driving of test piles designated as dynamic load test piles. Refer to the Article entitled "Submittals" herein for requirement for submitting qualifications of specialty consultant.

B. Prior to placement in the leads, the Contractor shall make each designated concrete pile available for taking wave speed measurements and for pre-drilling the required instrument attachment holes. Pre-driving wave speed measurements will not be required for steel piles. When wave speed measurements are made, the piling shall be in a horizontal position and not in contact with other piling.

C. The Contractor shall furnish the equipment, materials, and labor necessary for drilling holes in the piles for mounting the instruments. Instruments will be attached near the head of the pile with expansion-type bolts for concrete piles or through drilled holes on steel piles.

D. The Contractor shall provide access to the pile for attaching instruments after the pile is placed in the leads. A platform with minimum size of 4 by 4 feet (16 square feet) designed to be raised to the top of the pile while the pile is located in the leads shall be provided by the Contractor.

E. The Contractor shall furnish electric power for the dynamic test equipment. The power supply at the outlet shall be 10 amp, 115 volt, 55-60 cycle, A.C. only. Field generators used as the power source shall be equipped with meters for monitoring voltage and frequency levels.

F. The Contractor shall drive the pile to the design tip elevation or other depth specified by the Contractor's geotechnical engineer. The stresses in the piles will be monitored during driving with the dynamic test equipment to ensure that the values determined do not exceed the allowable values. If necessary, the Contractor shall reduce the driving energy transmitted to the pile by using additional cushions or reducing the energy output of the hammer in order to maintain stresses below the allowable values. If non-axial driving is indicated by the dynamic test equipment measurements, the Contractor shall immediately realign the driving system.

G. The Contractor shall wait up to 24 hours and, after the instruments are re-attached, re-drive the dynamic load test pile. A cold hammer shall not be used for the re-drive. After re-driving, the Contractor's geotechnical engineer shall either provide the cut-off elevation or specify additional pile penetration and testing for that dynamic load test pile. CAPWAP analyses of dynamic pile testing data shall be performed on data obtained for the beginning of re-drive of the driven piles.

H. The Contractor shall reduce the energy of the hammer and/or make other adjustments as necessary, if the stress exceeds the specified limit.

I. The Contractor shall conduct one analysis per foundation (abutment or bent) of the Case Pile Wave Analysis Program (CAPWAP) from the Pile Driving Analyzer (PDA) testing. The Contractor shall suspend pile driving on the foundation until the CAPWAP results are presented and the Contractor's geotechnical engineer gives notice that results indicate sufficient capacity has been obtained.

3.7 INSTALLATION OF PRODUCTION PILES

A. Penetration and Bearing: Install piles to the required penetration, or to the required bearing, if deeper than the required penetration, as determined by the various load tests performed for the purpose. Jetting shall not be permitted.

B. Predrilled Holes:

1. Where piles are to be driven through new embankment and the depth of the embankment is greater than 5 feet at the pile location, drive the pile in a hole, drilled through the embankment, of diameter not greater than the smallest cross-section dimension of a square or octagonal pile or of a diameter not greater than one inch less than the diameter of a circular pile. After driving the pile, fill any annular space around the pile with grout.
2. When necessary to achieve the required penetration, drill holes of diameter not greater than 90 percent of the least cross-sectional dimension of the pile at the depth being

drilled, and drive the pile therein to the required penetration. Locations and types of pre-drilling shall be approved by the Contractor's geotechnical engineer in writing.

3. When, in the Contractor's opinion, a larger hole is needed to prevent damage to piles, submit substantiating data and obtain the Contractor's geotechnical engineer's written approval before drilling holes of larger cross-section. Holes greater than 100 percent of the cross-sectional dimension of the pile will not be permitted.

C. Pile Driving:

1. Do not drive piles within 20 feet of concrete less than seven days old.
2. Drive interior footing piles before driving perimeter piles.
3. If necessary, provide adequate lateral support for installed individual piles to prevent excessive temporary flexural stresses or movement of the pile top out of tolerance.
4. Maintain the hammer coaxial with the pile during the driving operation by using a combination of driving cap and leads.
5. Investigate any sudden decrease in driving resistance for possible breakage of the pile. If a sudden decrease in driving resistance cannot be correlated to boring data or some incident in the driving, and if the pile cannot be inspected, such decrease in driving resistance will be cause for rejection of the pile.
6. Re-drive any pile that is raised during driving of adjacent piles, to the original tip elevation.
7. Splice piles only by methods and at places approved by the Contractor's structural engineer in writing.
8. Cut off piles at top elevation indicated. Repair piles that are damaged when cut off requires written approval of the Contractor's structural engineer.

D. Type A Piles:

1. Design the driving cap with grooves in the base to conform loosely to the "H" configuration of the pile. The bearing surface of the grooves shall be true, without roughness. The driving cap shall extend down the side of the pile at least four inches and shall be loosely attached to the hammer so that it will, at all times, rest squarely over the entire surface of the pile.
2. Make splices as indicated by electric-arc field welding in accordance with ANSI/AWS D1.1. Cut-off damaged portion of pile top before splicing. Take care to align the sections connected so that the axis of the pile will be straight. Refer to Section 05 05 22, Metal Welding, for welding requirements.

E. Type B Piles:

1. Protect the heads of piles from direct impact of the hammer by using an approved head block or shoe.
2. Make splices as indicated by electric-arc field welding in accordance with ANSI/AWS D1.1. Cut-off damaged portion of pile top before splicing. Take care to align the sections connected so that the axis of the pile will be straight. Refer to Section 05 05 22, Metal Welding, for welding requirements.
3. Remove rejected pipe pile and replace with new pipe. When rejected pipe pile cannot be removed, furnish and install replacements. Cut off abandoned pipe 3 feet below the structure, and fill the abandoned pipe with controlled density fill as specified in Section 03 05 15, Portland Cement Concrete. Backfill and compact holes.

4. Concrete shall be placed using tremie pipe that can extend to the bottom of the pipe. Concrete shall not be allowed to free fall during placement. Vibration of the concrete will not be required except in the top 30 feet of the pipe. Discharge concrete into the hopper at a continuous and rapid rate. Any break in the placement of the concrete shall be the basis for rejection of the pile. The volume of concrete placed shall be recorded and compared to the volume of concrete required to fill the pipe. Any variance between the volume of the pipe and the volume of concrete required to fill the pipe may be the basis for rejection of the pile.
5. Pipe piles may be driven with open ends, and the soil, rock or deleterious material adequately removed with auger or by other approved method to width and depth indicated to allow concrete to bond to the inside of the pipe. Inspect driven pipe shell for internal damage and misalignment and for the presence of water, and correct damaged or defective conditions before placement of concrete. Piles partially filled with water shall be dewatered or concrete-filled using the tremie method.
6. Do not allow vibrators to penetrate concrete that has taken initial set.

F. Type C Piles:

1. Protect the heads of piles from direct impact of the hammer by acceptable cushion head block, so that no cracking, spalling, or chipping occurs.
2. If piles have extended reinforcing steel and protective concrete for driving, remove such protective concrete to expose the reinforcing steel upon completion of driving.
3. When piles are driven or cut off below the elevation of the bottom of the cap, extend the pile to the elevation of the bottom of the cap by means of a reinforced concrete extension. Obtain Contractor's structural engineer approval of details prior to fabrication.
4. When piles have achieved design capacities and are left above the cutoff elevation, cutoff the pile to the specified cutoff elevation. If this cutoff results in excessive reinforcing steel being removed from the pile, retrofit pile as needed to meet the design intent. Obtain Contractor's structural engineer approval of details prior to fabrication. Remove and replace such piles as cannot be retrofitted.
5. Contractor's structural engineer shall verify that piles which are cut-off and not retrofitted are sufficient to fulfill the design intent. Document the structural engineer's verification.

3.8 INSTALLATION TOLERANCES

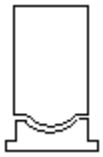
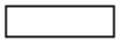
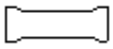
A. Deviation from plumb and angle of batter: 1/4 inch per foot of pile length, but not more than 6 inches overall.

B. Deviation from location of pile top: 6 inches.

Sheet # _____

Pile and Driving Equipment Data

Project No: _____
Project Name: _____ County: _____
Drawing No: _____
General Contractor: _____
Pile Driving Contractor/Subcontractor: _____
Phone: _____ FAX: _____
(Piles driven by, foreman): _____
Date Submitted: _____

Hammer Components		**Hammer**	Manufacturer: _____ Model: _____ Type: _____ Serial No: _____ Manufacturer=s Maximum Rated Energy: _____(ft-lb) Stroke at Maximum Rated Energy: _____(ft) Range in Operating Energy: ____ to ____(ft-lb) Range in Operating Stroke: ____ to ____(ft) Modifications: _____ _____
		Ram	Ram Weight: _____ (lb) Ram Length: _____(ft) (for diesel hammers)
		Anvil	Ram Cross Sectional Area: _____(in^2) (With diesel hammers) Anvil Weight: _____(lb)
		**Hammer Cushion**	Material #1 Material #2 Name: _____ _____ Area: _____ _____ (in^2) No. of Plates: _____ _____ Thickness: _____ _____ (in) Mod. of Elasticity - E: _____ _____ (psi) Coeff. of Restitution - e: _____ _____
		**Pile Cap**	Helmet Bonnet Anvil Block Weight: _____(lb) Drive Head
		**Pile Cushion (Only for Concrete or Timber Piles)**	Material: _____ Area: _____ (in^2) No. of Sheets: _____ Thickness/Sheet: _____ (in) Total Thickness of Pile Cushion: _____ (in) Mod. of Elasticity - E: _____ (psi) Coeff. of Restitution - e: _____
Pile		**Pile**	Diameter: _____ (in) Wall Thickness: _____ (in) Taper (if any): _____ Length in Leads: _____ (ft) Ordered Length: _____(ft) Required Ultimate Capacity: _____ (lb) Description of Splice: _____ Tip Treatment/Plate Description: _____

Use Separate Data Sheet for Each Proposed Hammer and Unique Driving Condition

END OF SECTION